PATENT SPECIFICATION 706,893

Inventors:—DAVID McNICOLL and ROLAND TREEN.

Date of filing Complete Specification : Feb. 25, 1953.

Application Date: July 23, 1952. No. 18576/52.

Complete Specification Published: April 7, 1954.

Index at Acceptance:—Class 12(1), A5C(1 : 2 : 3 : 5).

COMPLETE SPECIFICATION.

Improvements relating to Roller Bearings.

We, BRITISH TIMKEN LIMITED, a Company registered under the laws of Great Britain, of 65 Cheston Road, Aston, Birmingham, 7, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to roller bearings of the cross-roll or X-type comprising two series of rollers all arranged to form a single row or ring, one series having their axes inclined in one direction with respect to the axis of the bearing and the other series having their axes inclined in the opposite direction, the one series rolling on opposed race surfaces on inner and outer bearing members and the other series also running on opposed race surfaces on inner and outer bearing members, the two outer race surfaces and likewise the two inner race surfaces forming the walls or surfaces of two opposed V-grooves in which the rollers are located.

In known bearings of the above type which support radial and axial pressures, the forces in the direction of the roller axis are resisted either by flanges formed at the end of one or both of a pair of raceways, or by raceways which are opposed to the ends of the rollers.

An object of the present invention is to provide a roller bearing of the type referred to which dispenses with flanges at the ends of the raceways and in which the raceway surfaces are relieved of all but the actual raceway pressures from the peripheral running surfaces of the rollers.

Another object is to construct the bearing so that the angle at which the raceways of the inner and/or outer bearing members are disposed relatively to one another, may be widely varied in order to provide differing ratios of thrust to radial load capacity.

According to the invention a roller bearing, of the type referred to, is characterised by the fact that the race surfaces forming the walls or surfaces of the V-grooves in which the rollers are located, or certain of said race surfaces, are provided with annular ribs or collars situated intermediate their ends, and that the two series of rollers are provided, intermediate their ends, with circumferential grooves engaged by ribs or collars on race surfaces upon which they run.

Only two of the four race surfaces may be provided with the ribs or collars, one series of rollers having rolling engagement with one of said two surfaces and the other series of rollers having rollers engagement with the other of said surfaces.

The axis of each roller in each of the series of rollers lies on the surface of a cone whose axis is on the axis of rotation of the bearing; the two cones corresponding to the two series of rollers are interpenetrating with their apices pointing outwards at opposite sides of the bearing, and their common plane of intersection (on which the two outer races intersect and the two inner races intersect) is at right-angles to the axis of rotation of the bearing and is the plane on which lies the centre of the bearing.

Figure 1 of the accompanying drawings is a transverse section through a portion of a bearing in accordance with one embodiment of the invention, one of the rollers that are inclined in the one direction being shown in elevation;

Fig. 2 is a transverse section similar to Figure 1 but taken on a different plane so as to show in elevation one of the rollers that are inclined in the other direction;

Figure 3 is a cross-section through the

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outer race member with the rollers and cage shown in perspective elevation;

Figure 4 is a cross-section through a modification in which the bearing has an inner member which is in two parts and a one-piece outer member;

Figure 5 represents a cross-sectional view of another modified form of bearing in which both inner and outer race members are in the form of one-piece rings. This section is taken through one of the pockets of the two-piece cage which may be employed in this form of bearing;

Figure 6 is another cross-sectional view through this modification, the section being taken through one of the bars of the cage.

Referring to Figures 1 to 3 of the drawings, which show a convenient embodiment of the invention in connection with a taper-roller X-type bearing, the said bearing has a one-piece outer race member 1 having around its inner periphery two side-by-side raceways or tracks 2, 3, inclined in opposite directions to form the walls or surfaces of a V-shaped groove. The inner member of the bearing consists of two side-by-side race rings 4, 5, having respective conical race surfaces 6, 7, of opposite inclination and forming the walls or sides of a V-shaped groove, the ends of the said rings which are of the smallest section abutting each other. The arrangement of the inner and outer members is sunch that each of the two race surfaces 2, 3, on the outer member is opposed to a race surface 7, 6, respectively, on the inner member. Two adjacent raceways of the four raceway surfaces are provided with annular ribs or collars 8, 9, situated at points intermediate their ends, as at the middle. The two surfaces thus provided with the ribs 8, 9, are, in the example illustrated, the surfaces 2, 3, on the outer member 1, and the race surfaces 6, 7, opposed to the ribbed surfaces 2, 3, are plain and unbroken for their entire length. The ribs or collars 8, 9, may be integral with the race member or they may be formed as separate rings located in grooves.

Interposed between the inner and outer race members are two series of tapered rollers 10, 11, those of one series 10 being inclined in one direction with respect to the axis of the bearing and those of the other series being inclined in the opposite direction, the two series forming a single row in which some of the rollers are inclined in one direction and some are inclined in an opposite direction.

Alternate rollers of the single row may be inclined in opposite directions, as shown in Figure 3; or groups of two or more adjacent rollers may be inclined in one direction and other groups inclined in the opposite direction.

The numbers of rollers inclined in one direction may be equal to the numbers inclined in the opposite direction; or the numbers in the two series may be unequal, to provide a greater load-carrying capacity in one series than in the other.

The peripheral surfaces of the one series of rollers 10 have rolling engagement with two opposed race surfaces 2, 7, of which one is an outer race and the other an inner race, and the surfaces of the other series of rollers 11 have similar rolling engagement with the other two opposed race surfaces 3, 6.

Each roller of the two series is provided at a point between its ends, as at the middle, with a circumferential groove 12, 12^1, respectively and these grooves 12 of the one series of rollers 10 engage the rib or collar 8 on the ribbed raceway 2 whilst the grooves 12^1 of the other series of rollers 11 engage the rib or collar 9 on the ribbed raceway 3. The rollers of each series are of such a length axially that they run clear of the rib or collar 8 or 9 engaging the other series of rollers.

The co-operating grooves and ribs locate the rollers and prevent them from sliding endwise along their own axis, thus resisting end thrust and any tendency for axial displacement.

The two series of grooved rollers are disposed so that the axes of the rollers in each series lie on the surface of a cone whose axis is on the axis of rotation of the bearing. The two cones corresponding to the two series of rollers interpenetrate, with their apices pointing towards at opposite sides of the bearing; and their common plane of intersection is at right-angles to the axis of rotation of the bearing, being coincident with the centre of the bearing.

A one-piece cage or retainer 13 of the kind described in our Application for Patent No. 689,261 may conveniently be provided, being disposed adjacent the race surfaces 6, 7, which are not provided with ribs, as shown; or a cage of any known or suitable form may be employed. If desired a cage may be dispensed with.

The dimensions and form of the groove in each roller and its position relative to the roller ends are designed in conformity with the angles and desired dimensions of the rollers and tracks. The dimensions and form of the rib or collar are similarly determined. The contact between the faces of the grooves 12, 12^1, and of the ribs 8, 9, may be a point, a straight line, or an area having a spherical surface; or it may be similar to that defined in our Patent No. 541,459, being initially a point or line when the bearing is unloaded but becoming a full surface contact when the bearing is fully loaded.

The rollers may be tapered or conical as above described, or they may be cylindrical

or symmetrical or asymmetrical barrel-shaped.

Instead of load-carrying capacity as between one series of rollers and the other being varied by varying the numbers of rollers in the two respective series, the geometrical construction could be varied to produce the desired result.

In the modification shown in Figure 4, the outer member 1 of the bearing is in one piece with race surfaces 2, 3, and the inner member is in the form of two rings 4, 5, with race surfaces 6, 7, as in Figures 1 to 3, but circumferential ribs 8^1, 9^1, are provided upon inner race surfaces 7, 6, respectively for engagement respectively with the circumferential grooves 12, 12^1, of the oppositely-inclined rollers 10, 11, instead of ribs being provided on the outer race surfaces, as in Figures 1 to 3. In this case the cage 13 employed may be generally similar to the cage in Figures 1 and 2, but is provided around its inner inclined faces with circumferential grooves 18, 18^1, respectively, which clear the ribs 9^1, 8^1.

Figures 5 and 6 show another modification in which both inner and outer members 45, 1^1, are of one-piece construction, the rollers 10, 11, being assembled by eccentric disposition of the said members, in the well-known manner. Ribs 9^1, 8^1, are provided on the race surfaces 6, 7, of the inner member for engagement with the grooves 12, 12^1, of the respective series of rollers. In this modification, with both inner and outer members in one piece, it would not be possible to assemble a cage of the kind shown in Figures 1 to 4, and therefore a two-piece cage is employed consisting of separate end rings 15, 15, each carrying inwardly-extending circumferentially-spaced arms 16, 16. After the rollers have been assembled, the cage rings are fitted from opposite sides so that the arms 16 of the two rings butt together in alignment at the middle and together form bars which define pockets or openings in which the respective rollers are housed. When the two cage parts have been placed together in this manner they are permanently secured together, as by rivets 17 passed through holes provided in the arms. Or, the abutting ends of the arms could be welded or otherwise secured together. This form of cage could be used in the bearings shown in Figures 1 to 4. In this modification the angle between the race surfaces 6, 7, is considerably greater than the angle between the corresponding race surfaces in the case of Figures 1 to 3 and Figure 4.

If desired, the outer member of the bearing may be in two parts and the inner member in one piece, or the inner and outer members of the bearing may each be in two parts. Also, instead of the ribs being only on the outer member or only on the inner member, as described above, ribs may be provided on all four race surfaces, or one may be on an outer race and another on an adjacent inner race. In these cases a suitable form of cage, such as that shown in Figures 5 and 6, would be used.

It is to be understood that the dimensions of the races, rollers and ribs may be so chosen relatively to each other, that whilst the rollers run clear of the ribs, the rollers will have a maximum length of body on either side of their intermediate grooves to ensure satisfactory rolling contact.

The bearing could, if desired, be used as a purely thrust bearing.

What we claim is:—

1. A roller bearing, of the type referred to, characterised by the fact that the race surfaces forming the walls or surfaces of the V-grooves in which the rollers are located, or certain of said race surfaces, are provided with annular ribs or collars situated intermediate their ends, and that the two series of rollers are provided, intermediate their ends, with circumferential grooves engaged by the said ribs or collars on race surfaces upon which they run.

2. A roller bearing as claimed in Claim 1, in which only two of the four race surfaces are provided with the ribs or collars, one series of rollers having rolling engagement with one of said surfaces and the other series of rollers having rolling engagement with the other of said surfaces.

3. A roller bearing as claimed in any one of the preceding claims, having a two-part cage comprising two separate end rings each provided with inwardly-extending circumferentially-spaced arms which, when the two parts of the cage have been applied to the rollers after assembly thereof, are secured together at their abutting ends.

4. A roller bearing substantially as herein described with reference to Figures 1 to 3, Figure 4 or Figures 5 and 6 of the accompanying drawings.

H. N. & W. S. SKERRETT,
24 Temple Row, Birmingham 2,
Agents for the Applicants.

PROVISIONAL SPECIFICATION.

Improvements relating to Roller Bearings.

We, BRITISH TIMKEN LIMITED, a Company registered under the laws of Great Britain, of 65 Cheston Road, Aston, Birmingham, 7, do hereby declare this invention to be described in the following statement:—

This invention relates to roller bearings

of the cross-roll or X-type comprising two series of rollers all arranged to form a single row or ring, one series having their axes inclined in one direction with respect to the axis of the bearing and the other series having their axes inclined in the opposite direction, the one series rolling on opposed race surfaces on inner and outer bearing members and the other series also running on opposed race surfaces on inner and outer bearing members, the two outer race surfaces and likewise the two inner race surfaces forming the walls or surfaces of two opposed V-grooves in which the rollers are located.

In known bearings of the above type which support radial and axial pressures, the forces in the direction of the roller axis are resisted either by flanges formed at the end of one or both of a pair of raceways, or by raceways which are opposed to the ends of the rollers.

An object of the present invention is to provide a roller bearing of the type referred to which dispenses with flanges at the ends of the raceways and in which the raceway surfaces are relieved of all but the actual raceway pressures from the peripheral running surfaces of the rollers.

Another object is to construct the bearing so that the angle at which the raceways of the inner and/or outer bearing member are disposed relatively to one another, may be widely varied in order to provide differing ratios of thrust to radial load capacity.

According to the invention a roller bearing, of the type referred to, is characterised by the fact that the race surfaces forming the walls or surfaces of the V-grooves in which the rollers are located, or certain of said race surfaces, are provided with annular ribs or collars situated intermediate their ends, and that the two series of rollers are provided, intermediate their ends, with circumferential grooves engaged by ribs or collars on race surfaces upon which they run.

Only two of the four race surfaces may be provided with the ribs or collars, one series of rollers having rolling engagement with one of said surfaces and the other series of rollers having rolling engagement with the other of said surfaces.

The rollers and ribs are so dimensioned relative to the races that rollers of one series will run clear of the rib or collar associated with the other series. The axis of each roller in each of the series of rollers lies on the surface of a cone whose axis is on the axis of rotation of the bearing; the two cones corresponding to the two series of rollers are interpenetrating with their axes pointing outwards at opposite sides of the bearing, and their common plane of intersection on which the two outer races intersect and the two inner races intersect is at right-angles to the axis of rotation of the bearing and is the plane on which lies the centre of the bearing.

In carrying out a convenient embodiment of the invention in connection with a taper-roller X-type bearing, the said bearing has a one-piece inner race member having around its outer periphery two side-by-side raceways or tracks inclined in opposite directions to form the walls or surfaces of a V-shaped groove, so that the said race member has its smallest diameter substantially on the transverse centre line of the bearing. The outer part of the bearing consists of two side-by-side outer race members having conical race surfaces of opposite inclination and forming the walls or sides of a V-shaped groove, the ends of the members which are of the smallest section abutting each other. The arrangement of the inner and outer members is such that each of the two race surfaces on the outer members is opposed to a race surface on the inner member. Two adjacent raceways of the four raceway surfaces are provided with annular ribs or collars situated at points intermediate their ends, as at the middle. The two surfaces thus provided with the ribs may be those on the outer members, or those on the inner member, or one may be on an outer member and the other an adjacent surface on the inner member: but in any case the race surface opposed to each ribbed surface is plain and unbroken for its entire length. The ribs or collars may be integral with the race members or they be formed as separate rings located in grooves in the race members.

Interposed between the inner and outer race members are two series of tapered rollers those of one series being inclined in one direction with respect to the axis of the bearing and those of the other series being inclined in the opposite direction, the two series forming a single row in which some of the rollers are inclined in one direction and some are inclined in an opposite direction.

Alternate rollers of the single row may be inclined in opposite directions, or groups of two or more adjacent rollers may be inclined in one direction and other groups inclined in the opposite direction.

The numbers of rollers inclined in one direction may be equal to the numbers inclined in the opposite direction: or the numbers in the two series may be unequal, to provide a greater load-carrying capacity in one series than in the other.

The peripheral surfaces of the one series of rollers have rolling engagement with two opposed race surfaces of which one is an inner bearing member race and one an outer bearing member race, and the surfaces of the other series of rollers have similar

rolling engagement with the other two opposed race surfaces.

Each roller of the two series is provided at a point between its ends, as at the middle, with a circumferential groove, and these grooves of the one series engage the ribs or collars on one of the two ribbed raceways whilst those of the other series engage the rib or collar on the other of said ribbed raceways. The rollers of each series are of such a length axially that they run clear of the rib or collar engaging the other series of rollers.

The co-operating grooves and ribs locate the rollers and prevent them from sliding endwise along their own axes, thus resisting end thrust and any tendency for axial displacement.

The two series of grooved rollers are disposed so that the axes of the rollers in each series lie on the surface of a cone whose axis is on the axis of rotation of the bearing. The two cones corresponding to the two series or rollers interpenetrate, with their apices pointing outwards at opposite sides of the bearing; and their common plane of intersection is at right-angles to the axis of rotation of the bearing, being coincident with the centre of the bearing.

A one-piece cage or retainer of the kind described in our Application for Patent No. 21686/50 may be provided, or a cage of any known or suitable form may be employed.

The dimensions and form of the groove in each roller and its position relative to the roller ends are designed in conformity with the angles and desired dimensions of the rollers and tracks. The dimensions and form of the rib or collar are similarly determined. The contact between the faces of the grooves and of the rib may be a point, a straight line, an area having a spherical surface, or it may be similar to that defined in our Patent No. 541,459, being initially a point or line when the bearing is unloaded but becoming a full surface contact when the bearing is fully loaded.

The rollers may be tapered or conical as above described, or they may be cylindrical or symmetrical or asymmetrical barrel-shaped.

Instead of load-carrying capacity as between one series of rollers and the other being varied by varying the numbers of rollers in the two respective series, the geometrical construction could be varied to produce the desired result.

Instead of the outer bearing member being in two parts, it could consist of one part only, the inner member being made in two parts. Or, each of the inner and outer members may be in two parts.

Also, instead of the ribs being on the two outer race surfaces, they may both be on the inner race surfaces, or one on an outer surface and the other on an adjacent inner race surface. Or ribs may be provided on all four race surfaces.

The bearing could, if desired, be used as a purely thrust bearing.

H. N. & W. S. SKERRETT,
24 Temple Row, Birmingham 2,
Agents for the Applicants.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1954.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

706,893 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1.

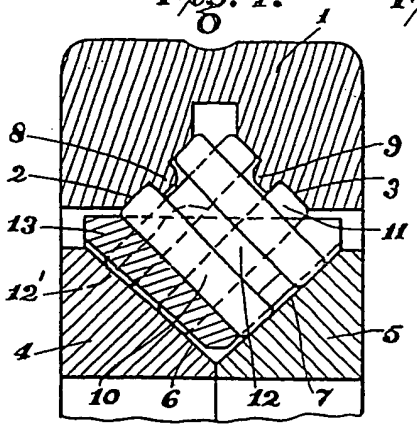

Fig. 3.

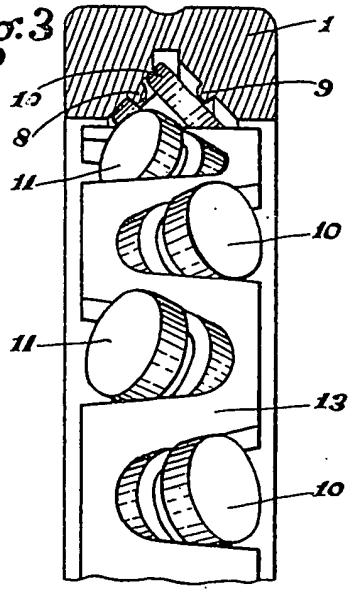

Fig. 2.

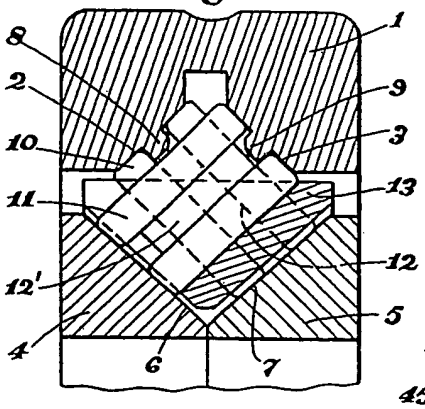

Fig. 5.

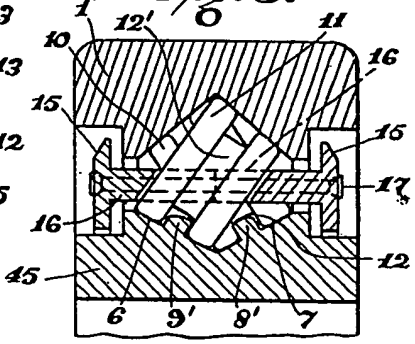

Fig. 4.

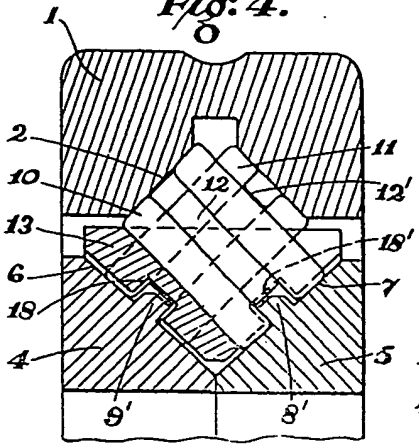

Fig. 6.